

# W3C<sup>®</sup> Privacy Overview

*What is new, where are related resources, etc.*

This document is a time-changing overview of resources about privacy, preference expression and the collection of Web usage data on the Web.

Please see

- **Platform for Privacy Preferences (P3P) Project** is our main activity.
- W3C Privacy Activity for a general description of our privacy activities.
- W3C Policy Interest Group

## Historical:

- W3C Announces the P3 Project at FTC Workshop (June 97)
- The Director announced approval of the P3P Project. (May 97)

## Public Meetings

- January 29-30, 1996. Workshop on Internet Survey Methodology and Web Demographics at MIT.  
Call for Papers Proceedings
- Federal Trade Commission (FTC) Workshop on Consumer Information Privacy.

## Technical Proposals

W3C: PICS Extension for HTTP Cookies 23-Oct-97, Daniel Jaye  
IETF draft-ietf-http-jaye-trust-state-02.txt

IETF: Cookies II: draft-ietf-http-state-man-mec-08.txt

Informal: "Proposals for Gathering Consumer Demographics", Dan Connolly, W3C.  
Discusses 3 proposals and the issues addressed.

Informal: Comment on proposals for gathering consumer demographics, TimBL

## Problem Statements and Papers

Direct Marketing on the Internet, G Kazarian, A Leuthold, S Olivares

Roger Clarke's Privacy Resources (Australian)

Numerical Literacy on the World-Wide Web, Jim Conaghan, NAA. Many pointers.

Web Stats discussion group at Advertising Age.

EFF DRAFT Public Internet Principles for Online Filtration, Ratings and Labeling Systems

## Current Status Report

The Web demographic and marketing field is extremely dynamic. We provide a selection of some of the key roles, and instances of those roles, in this domain.

### Web Marketing and Demographics

#### SiteTrack

This was announced very recently intervention. It c|net noted the "stealth" ability to track users without marks runs as a Netscape server extension that rewrites URLs like other products. Essentially sessions (combination of user-agent and ip addr); recall. can bind session-ids to uids for permanent Presumably GC's bookmarked session IDs.

#### I/PRO

I/PRO was one of the first movers. It has partnered with Nielsen Media Research. They separate counting, demographics, and auditing. Users can go to I/PRO to get an I/CODE that their software can pick up later.

#### IAB

Internet Audit Bureau gives you an account, and tells you to put a gif on your home page. Each gif access is tallied at the home office (much like latex2html...)

#### NetCount

Their "Real Accountability" brand goes online Oct. 30 (1996). They use SSL to accept encrypted logs for analysis at their site.

#### WebTrack

They have partnered with ABC to audit statistics, apparently by log auditing (See WebStat & FAQ). They have a comprehensive newsletter, WebTrack's InterAd Monthly.

#### Intersé

They are a Web-centric marketing and communication consultancy with log analysis tools. It includes the Intersé? Internet database of domain names indexed by zip, etc.

#### Streams Online Media Development

Lilypad is their "Internet Media Planning and Assessment Tool". Analyzes Referer fields. Rental model: \$695/month for analysis.

#### NPD Group, Inc.

Syndicated and custom research for many commercial and consumer industries, including PC-Meter, which provides audience measurement of web sites and on-line services with hardware monitoring.

### Ratings Firms

#### Nielsen Media Research / Nielsen Marketing Research

Arbitron (TV)

SoundScan (retail music)

ASCAP/BMI (music royalties)

## Advertisers

CASIE (Coalition for Advertiser Supported Information and Entertainment) CASIE Guiding Principles of Interactive Media Audience Measurement & Summary

NAA for newspapers (Newspaper Association of America)

MPA for magazines (Magazine Publishers Association) MPA Proposed Standards for Internet Advertising Measurement

ARF for advertisers (Advertising Research Foundation)

ABC (Audit Bureau of Circulations)

AAAA (American Association of Advertising Agencies)

AMA (The American Marketing Association)

Ad Council

## Privacy Players

CDT, Center for Democratic Technology, IPWG

EPIC, Electronic Privacy Information Center, (International Privacy Standards)

EFF, Electronic Frontier Foundation, (eTrust w/ CommerceNet)

VTW, Voters Telecommunications Watch

## "Privacy Companies"

Internet Junkbuster | Lucent Personalized Web Assistant | Pretty Good Privacy | interMute

## Agent Technologies

Firefly | Agents Technologies Corp.

Agents, Inc. | Artis Corporation | Open Sesame

Autonomy Corporation | WebSprite

Kinetoscope, Inc. | LifestyleFinder Agent

MobileWare Corporation | Surflogic, Inc.

Intelligent Agents for Electronic Commerce

## Search Engines

[Alta Vista](#) | [Hotbot](#)

[Lycos](#) | [Excite](#)

[InfoSeek](#) | [Yahoo](#)

[WEB Crawler](#) | [CUI 3#](#)

[WWW - the WORLD WIDE WEB WORM](#)

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## Media Attention

See [Yahoo Technical Coverage](#) for related news stories.

- [CNET - Radio Index of Commerce Department Meeting](#) (June 23/24)
- [Technology News from Wired News](#) (June 25 1998)
- [EU report seeks Net privacy laws](#) (CNET July 01, 1998)
- [Euro Commission plays down opinion on privacy standards](#) (IDJ, July 02, 1998)

## Relevant W3C Work

P3P is based on the [HTTP protocol](#) as well as the [W3C XML1.0 Recommendation](#) and the [Resource Description Framework \(RDF\)](#) work. Future version will leverage other W3C technologies such as [digital signatures \(DSig\)](#).

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[..Joseph Reagle](#)

[..Webmaster](#)

*Created October 1995 Last updated 21 December 1997*

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## A logical design methodology for relational databases using the extended entity-relationship model

Full text Pdf (2.16 MB)

Source **ACM Computing Surveys (CSUR)** [archive](#)  
Volume 18, Issue 2 (June 1986) [table of contents](#)  
Pages: 197 - 222  
Year of Publication: 1986  
ISSN: 0360-0300

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Publisher ACM Press New York, NY, USA

Additional Information: [abstract](#) [references](#) [citings](#) [index terms](#) [collaborative colleagues](#) [peer to peer](#)

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### ↑ ABSTRACT

A database design methodology is defined for the design of large relational databases. First, the data requirements are conceptualized using an extended entity-relationship model, with the extensions being additional semantics such as ternary relationships, optional relationships, and the generalization abstraction. The extended entity-relationship model is then decomposed according to a set of basic entity-relationship constructs, and these are transformed into candidate relations. A set of basic transformations has been developed for the three types of relations: entity relations, extended entity relations, and relationship relations. Candidate relations are further analyzed and modified to attain the highest degree of normalization desired. The methodology produces database designs that are not only accurate representations of reality, but flexible enough to accommodate future processing requirements. It also reduces the number of data dependencies that must be analyzed, using the extended ER model conceptualization, and maintains data integrity through normalization. This approach can be implemented manually or in a simple software package as long as a "good" solution is acceptable and absolute optimality is not required.

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Note: OCR errors may be found in this Reference List extracted from the full text article. ACM has opted to expose the complete List rather than only correct and linked references.

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#### ↑ INDEX TERMS

##### Classification:

H. Information Systems

↳ H.2 DATABASE MANAGEMENT

↳ H.2.1 Logical Design

↳ Subjects: Data models

##### General Terms:

Design, Management

#### ↑ Collaborative Colleagues:

|               |                          |                        |                         |
|---------------|--------------------------|------------------------|-------------------------|
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## The platform for privacy preference as a social protocol: An examination within the U.S. policy context

Full text:  Pdf (241 KB)Source: [ACM Transactions on Internet Technology \(TOIT\) archive](#)Volume 2, Issue 4 (November 2002) [table of contents](#)

Pages: 276 - 306

Year of Publication: 2002

ISSN: 1533-5399

Author: [Harry Hochheiser](#) University of Maryland, College Park, MD

Publisher: ACM Press New York, NY, USA

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### ↑ ABSTRACT

As a "social protocol" aimed at providing a technological means to address concerns over Internet privacy, the Platform for Privacy Preferences (P3P) has been controversial since its announcement in 1997. In the U.S., critics have decried P3P as an industry attempt to avoid meaningful privacy legislation, while developers have portrayed the proposal as a tool for helping users make informed decisions about the impact of their Web surfing choices. This dispute touches upon the privacy model underlying P3P, the U.S. political context regarding privacy, and the technical components of the protocol. This article presents an examination of these factors, with an eye towards distilling lessons for developers of future social protocols.

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**Primary Classification:**

K. Computing Milieux

↳ K.4 COMPUTERS AND SOCIETY

↳ K.4.1 Public Policy Issues

↳ **Subjects:** Privacy

**Additional Classification:**

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1 [The UCON<sub>ABC</sub> usage control model](#)

Jaehong Park, Ravi Sandhu

February 2004 **ACM Transactions on Information and System Security (TISSEC)**, Volume 7 Issue 1

Full text available: [pdf\(518.61 KB\)](#)

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In this paper, we introduce the family of UCON<sub>ABC</sub> models for usage control (UCON), which integrate *Authorizations (A)*, *obligations (B)*, and *Conditions (C)*. We call these core models because they address the essence of UCON, leaving administration, delegation, and other important but second-order issues for later work. The term usage control is a generalization of access control to cover authorizations, obligations, conditions, continuity (ongoing controls), and mutability. Trad ...

**Keywords:** access control, digital rights management, privacy, trust, usage control

2 [E-P3P privacy policies and privacy authorization](#)

Paul Ashley, Satoshi Hada, Günter Karjoth, Matthias Schunter

November 2002 **Proceeding of the ACM workshop on Privacy in the Electronic Society**

Full text available: [pdf\(146.35 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Enterprises collect large amounts of personal data from their customers. To ease privacy concerns, enterprises publish privacy statements that outline how data is used and shared. The Platform for Enterprise Privacy Practices (E-P3P) defines a fine-grained privacy policy model. A Chief Privacy Officer can use E-P3P to formalize the desired enterprise-internal handling of collected data. A particular data user is then allowed to use certain collected data for a given purpose if and only if the E- ...

**Keywords:** E-P3P, privacy manager, privacy policies

3 [Session 2: secure Web services: Designing a distributed access control processor for network services on the Web](#)

Reiner Kraft

November 2002 **Proceedings of the 2002 ACM workshop on XML security**

Full text available: [pdf\(301.14 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The service oriented architecture (SOA) is gaining more momentum with the advent of network services on the Web. A programmable and machine accessible Web is the vision of many, and might represent a step towards the semantic Web. However, security is a crucial requirement for the serious usage and adoption of the Web services technology. This paper enumerates design goals for an access control model for Web services. It then introduces an abstract general model for Web services components, along ...

**Keywords:** Web services, XML, access control, security

4 Laws and applications: 'I didn't buy it for myself' privacy and ecommerce

personalization

Lorrie Faith Cranor

October 2003 **Proceeding of the ACM workshop on Privacy in the electronic society**

Full text available: [pdf\(117.67 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Ecommerce personalization can help web sites build and retain relationships with customers, but it also raises a number of privacy concerns. This paper outlines the privacy risks associated with personalization and describes a number of approaches to personalization system design that can reduce these risks. This paper also provides an overview of the fair information practice principles and discusses how they may be applied to the design of personalization systems, and introduces privacy laws a ...

**Keywords:** ecommerce, personalization, privacy

5 Web services and performance evaluation: Preserving privacy in web services

Abdelmounaam Rezgui, Mourad Ouzzani, Athman Bouguettaya, Brahim Medjahed

November 2002 **Proceedings of the fourth international workshop on Web information and data management**

Full text available: [pdf\(238.19 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Web services are increasingly being adopted as a viable means to access Web-based applications. This has been enabled by the tremendous standardization effort to describe, advertise, discover, and invoke Web services. Digital government (DG) is a major application domain for Web services. It aims at improving government-citizen interactions using information and communication technologies. Government agencies collect, store, process, and share information about millions of citizens who have diff ...

**Keywords:** digital government, mobile agents, privacy, web services

6 Taking the byte out of cookies: privacy, consent, and the Web

Daniel Lin, Michael C. Loui

June 1998 **ACM SIGCAS Computers and Society, Proceedings of the ethics and social impact component on Shaping policy in the information age**, Volume 28 Issue 2

Full text available: [pdf\(1.99 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We consider the privacy of personal information on the World Wide Web, emphasizing a concept of privacy as an aspect of social relationships between individuals. We make three contributions to understanding the right to privacy on the Web: (1) we highlight the role of informed consent as an important consideration for privacy, (2) we identify conditions under which the collection and centralization of personal information can be ethically

justified, and (3) we offer an interpretation of a "reaso ...

7 Instance-based attribute identification in database integration

Cecil Eng H. Chua, Roger H. L. Chiang, Ee-Peng Lim

October 2003 **The VLDB Journal – The International Journal on Very Large Data Bases**, Volume 12 Issue 3

Full text available: [pdf\(220.13 KB\)](#) Additional Information: [full citation](#), [abstract](#), [index terms](#)

**Abstract.** Most research on attribute identification in database integration has focused on integrating attributes using schema and summary information derived from the attribute values. No research has attempted to fully explore the use of attribute values to perform attribute identification. We propose an attribute identification method that employs schema and summary instance information as well as properties of attributes derived from their instances. Unlike other attribute identification meth ...

**Keywords:** Attribute Identification, Database Integration, Measures of association

8 The platform for privacy preference as a social protocol: An examination within the U.S. policy context

Harry Höchheiser

November 2002 **ACM Transactions on Internet Technology (TOIT)**, Volume 2 Issue 4

Full text available: [pdf\(241.03 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

As a "social protocol" aimed at providing a technological means to address concerns over Internet privacy, the Platform for Privacy Preferences (P3P) has been controversial since its announcement in 1997. In the U.S., critics have decried P3P as an industry attempt to avoid meaningful privacy legislation, while developers have portrayed the proposal as a tool for helping users make informed decisions about the impact of their Web surfing choices. This dispute touches upon the privacy model under ...

**Keywords:** P3P, Privacy, social protocols

9 Supporting relationships in access control using role based access control

John Barkley, Konstantin Beznosov, Jinny Uppal

October 1999 **Proceedings of the fourth ACM workshop on Role-based access control**

Full text available: [pdf\(1.19 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

10 Protocols: An XPath-based preference language for P3P

Rakesh Agrawal, Jerry Kiernan, Ramakrishnan Srikant, Yirong Xu

May 2003 **Proceedings of the twelfth international conference on World Wide Web**

Full text available: [pdf\(107.76 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The Platform for Privacy Preferences (P3P) is the most significant effort currently underway to enable web users to gain control over their private information. The designers of P3P simultaneously designed a preference language called APPEL to allow users to express their privacy preferences, thus enabling automatic matching of privacy preferences against P3P policies. Unfortunately subtle interactions between P3P and APPEL result in serious problems when using APPEL: Users can only directly spe ...

**Keywords:** APPEL, P3P, XPath, XPref, hippocratic databases, preference, privacy-aware data management

### 11 Concepts for personal location privacy policies

Einar Snekkenes

October 2001 **Proceedings of the 3rd ACM conference on Electronic Commerce**

Full text available:  pdf(245.64 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A Location Based Service (LBS) is a service where knowledge of the location of an object or individual is used to personalise the service. Typical examples include the E911 emergency location service in the US and 'Where is the nearest xx' type of services. However, since these services often may be implemented in a way that exposes sensitive personal information, there are several privacy issues to consider. A key question is: "Who should have access to what location information under which cir ...

**Keywords:** EDGE, GPRS, GSM, PCS, UMTS, IMode privacy policy

### 12 Privacy through pseudonymity in user-adaptive systems

Alfred Kobsa, Jörg Schreck

May 2003 **ACM Transactions on Internet Technology (TOIT)**, Volume 3 Issue 2

Full text available:  pdf(881.69 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

User-adaptive applications cater to the needs of each individual computer user, taking for example users' interests, level of expertise, preferences, perceptual and motoric abilities, and the usage environment into account. Central user modeling servers collect and process the information about users that different user-adaptive systems require to personalize their user interaction. Adaptive systems are generally better able to cater to users the more data their user modeling systems collect and ...

**Keywords:** Chaum mix, KQML, User modeling, access control, anonymity, encryption, personal information, personalization, privacy, pseudonymity, reference model, secrecy, security, user-adaptive systems

### 13 Cases and experiences: Lost in translation: a critical analysis of actors, artifacts, agendas, and arenas in participatory design

Rogério DePaula

July 2004 **Proceedings of the eighth conference on Participatory design: Artful integration: interweaving media, materials and practices - Volume 1**

Full text available:  pdf(341.11 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

As computer technologies start to permeate the everyday activities of a continuously growing population, social and technical as well as political and legal issues will surface. Participatory design is asked to take a more critical view of participation, design, technology, and the arenas in which the network of actors and artifacts dialectically construct the social orders. This paper has a much more modest aim of that to contribute the discussion of participation and design in part by a more I ...

**Keywords:** Web2gether, actor-network theory, adoption, arenas for participation, collaboration, legal aspects, participatory design, privacy, social networks, special education, translations

### 14

### Ubiquitous WWW: The social contract core



James H. Kaufman, Stefan Edlund, Daniel A. Ford, Calvin Powers  
May 2002 **Proceedings of the eleventh international conference on World Wide Web**

Full text available:  [pdf\(227.12 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The information age has brought with it the promise of unprecedented economic growth based on the efficiencies made possible by new technology. This same greater efficiency has left society with less and less time to adapt to technological progress. Perhaps the greatest cost of this progress is the threat to privacy we all face from unconstrained exchange of our personal information. In response to this threat, the World Wide Web Consortium has introduced the "Platform for Privacy Preferences" ( ...

**Keywords:** P3P, privacy, social contract

15 HTTP Cookies: Standards, privacy, and politics

David M. Kristol

November 2001 **ACM Transactions on Internet Technology (TOIT)**, Volume 1 Issue 2

Full text available:  [pdf\(390.38 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

How did we get from a world where cookies were something you ate and where "nontechies" were unaware of "Netscape cookies" to a world where cookies are a hot-button privacy issue for many computer users? This article describes how HTTP "cookies" work and how Netscape's original specification evolved into an IETF Proposed Standard. I also offer a personal perspective on how what began as a straightforward technical specification turned into a political flashpoint when it tried to address nontech ...

**Keywords:** Cookies, HTTP, World Wide Web, privacy, state management

16 The platform for privacy preferences

Joseph Reagle, Lorrie Faith Cranor

February 1999 **Communications of the ACM**, Volume 42 Issue 2

Full text available:  [pdf\(212.61 KB\)](#)  [html\(41.98 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

17 Special issue on natural language generation: Collaborative response generation in planning dialogues

Jennifer Chu-Carroll, Sandra Carberry

September 1998 **Computational Linguistics**, Volume 24 Issue 3

Full text available:  [pdf\(3.45 MB\)](#)  [html\(41.98 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)  
[Publisher Site](#)

In collaborative planning dialogues, the agents have different beliefs about the domain and about each other; thus, it is inevitable that conflicts arise during the planning process. In this paper, we present a plan-based model for response generation during collaborative planning, based on a recursive *Propose-Evaluate-Modify* framework for modeling collaboration. We focus on identifying strategies for content selection when 1) the system initiates *information-sharing* to gather fur ...

18 Electronic commerce: a half-empty glass?

Sasa Dekleva

June 2000 **Communications of the AIS**

Full text available:  [pdf\(343.49 KB\)](#) Additional Information: [full citation](#), [references](#)

**19 FARA: reorganizing the addressing architecture**

David Clark, Robert Braden, Aaron Falk, Venkata Pingali

August 2003 **ACM SIGCOMM Computer Communication Review , Proceedings of the ACM SIGCOMM workshop on Future directions in network architecture,**  
Volume 33 Issue 4

Full text available:  [pdf\(190.55 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

*sloppy* This paper describes FARA, a new organization of, network architecture concepts. FARA (Forwarding directive, Association, and Rendezvous Architecture) defines an abstract model with considerable generality and flexibility, based upon the decoupling of end-system names from network addresses. The paper explores the implications of FARA and the range of architecture instantiations that may be derived from FARA. As an illustration, the paper outlines a particular derived architecture, ...

**Keywords:** Architecture, Association, Instantiation, Mobility, Model, Modularity, Network, Rendezvous, Security

**20 Trust online**

Batya Friedman, Peter H. Khan, Daniel C. Howe

December 2000 **Communications of the ACM**, Volume 43 Issue 12

Full text available:  [pdf\(101.92 KB\)](#)  [html\(35.17 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

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## Preserving privacy in web services

Full text [Pdf \(238 KB\)](#)

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McLean, Virginia, USA  
**SESSION:** Web services and performance evaluation [table of contents](#)  
Pages: 56 - 62  
Year of Publication: 2002  
ISBN: 1-58113-593-9

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**Sponsors** [ACM](#): Association for Computing Machinery  
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**Publisher** [ACM Press](#) New York, NY, USA

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### ↑ ABSTRACT

Web services are increasingly being adopted as a viable means to access Web-based applications. This has been enabled by the tremendous standardization effort to describe, advertise, discover, and invoke Web services. Digital government (DG) is a major application domain for Web services. It aims at improving government-citizen interactions using information and communication technologies. Government agencies collect, store, process, and share information about millions of citizens who have different preferences regarding their privacy. This naturally raises a number of legal and technical issues that must be addressed to preserve citizens' privacy through the control of the information flow amongst different entities (users, Web services, DBMSs). Solutions addressing this issue are still in their infancy. They consist, essentially, of enforcing privacy by law or by self-regulation. In this paper, we propose a new technical approach for preserving privacy in government Web services. Our design is based on digital privacy credentials, data filters and mobile privacy preserving agents. This work aims at establishing the feasibility and provable reliability of technology-based privacy preserving solutions for Web service infrastructures.

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Note: OCR errors may be found in this Reference List extracted from the full text article. ACM has opted to expose the complete List rather than only correct and linked references.

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K. Hogg, P. Chilcott, M. Nolan, B. Srinivasan, An evaluation of Web services in the design of a B2B application, Proceedings of the 27th conference on Australasian computer science, p.331-340, January 01, 2004, Dunedin, New Zealand

#### ↑ INDEX TERMS

**Primary Classification:****H. Information Systems**↳ **H.2 DATABASE MANAGEMENT**↳ **H.2.0 General****Additional Classification:****H. Information Systems**↳ **H.3 INFORMATION STORAGE AND RETRIEVAL**↳ **H.3.5 On-line Information Services**↳ **Subjects: Web-based services****General Terms:**Design, Management, Security**Keywords:**digital government, mobile agents, privacy, web services**↑ Collaborative Colleagues:**Athman Bouguettaya:James BeardBoualem BenatallahElisa BertinoJerry CameronAhmed ElmagarmidAhmed K. ElmagarmidAhmed K. ElmagarmidWelpling HeLily HendraRoger KingBernd J. KrämerBrahim MedjahedStephen MillinerSteven MillinerM. OuzzaniMourad OuzzaniMike PapazoglouMike P. PapazoglouMourad QuzzaniAbdelmounaam RezguiKevin SmithXu YangBrahim Medjahed:Boualem BenatallahAthman BouguettayaJerry CameronAhmed K. ElmagarmidAhmed K. ElmagarmidLily HendraM. OuzzaniMourad OuzzaniAbdelmounaam RezguiMourad Ouzzani:James BeardBoualem BenatallahAthman BouguettayaJerry CameronLily HendraBrahim MedjahedAbdelmounaam RezguiAbdelmounaam Rezgui:Athman BouguettayaBrahim MedjahedMourad Ouzzani**↑ Peer to Peer - Readers of this Article have also read:**

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### 1 [On the correctness of representing extended entity-relationship structures in the relational model](#)

Victor M. Markowitz, Arie Shoshani

June 1989 **ACM SIGMOD Record , Proceedings of the 1989 ACM SIGMOD international conference on Management of data**, Volume 18 Issue 2Full text available: [pdf\(1.56 MB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Although the relational representation of Entity-Relationship (ER) structures gained extensive coverage, scarce attention has been paid to the issue of correctness for such representations. Several mappings have been proposed for the representation of both ER and extended ER (EER) structures by relational schemas. The informal nature of most of these proposals, however, does not allow a precise evaluation of their correctness, nor a comparison of the various ...

### 2 [Database design: A practical design methodology for the implementation of IMS databases, using the entity-relationship model](#)

Ewing L. Lusk, Ross A. Overbeek, Bruce Parrello

May 1980 **Proceedings of the 1980 ACM SIGMOD International conference on Management of data**Full text available: [pdf\(967.85 KB\)](#)Additional Information: [full citation](#), [references](#), [citations](#)

### 3 [Entity-relationship diagrams and English: an analysis of some problems encountered in a database design course](#)

Judith D. Wilson

February 1987 **ACM SIGCSE Bulletin , Proceedings of the eighteenth SIGCSE technical symposium on Computer science education**, Volume 19 Issue 1Full text available: [pdf\(727.12 KB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The simplicity and clarity of the entity-relationship approach recommends its use as a tool for teaching database design. Nonetheless, the approach does not appear to be problem-free. Analysis of student entity-relationship diagrams for two database design projects reveals a tendency students have to model English sentences and to use English syntax to guide the modelling process. The paper discusses why this may be the case, and how it may be avoided.



4 An algebraic language for graphical query formulation using an extended entity-relationship model

Bogdan Czejdo, Ramez Elmasri, Marek Rusinkiewicz, David W. Embley

February 1987 **Proceedings of the 15th annual conference on Computer Science**

Full text available:  pdf(847.38 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The Entity-Category-Relationship (ECR) model extends the Entity-Relationship (ER) model with the concepts of subclass and generalization categories. In this paper a graphical representation of the ECR model and its application as the basis for an interactive query language are discussed. The proposed query language is based on algebraic operators that can be used to transform an ECR diagram so that it represents a desired query. Semantics of the algebraic operators are formally defined. A m ...

5 Semantics of update operations for an extended entity-relationship model

Bogdan Czejdo, Ramez Elmasri, Marek Rusinkiewicz, David W. Embley

February 1988 **Proceedings of the 1988 ACM sixteenth annual conference on Computer science**

Full text available:  pdf(993.90 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The Entity-Category-Relationship (ECR) model extends the Entity-Relationship (ER) model with the concepts of subclass and generalisation categories. In this paper semantics of update operations for the ECR model are discussed. The proposed update operations can be implemented as an interactive data manipulation language. This language is based on algebraic operators that can be invoked graphically to operate on ECR diagrams. A method of implementing the graphical ECR interface for accessing ...

6 A logical design methodology for relational databases using the extended entity-relationship model

Toby J. Teorey, Dongqing Yang, James P. Fry

June 1986 **ACM Computing Surveys (CSUR)**, Volume 18 Issue 2

Full text available:  pdf(2.16 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A database design methodology is defined for the design of large relational databases. First, the data requirements are conceptualized using an extended entity-relationship model, with the extensions being additional semantics such as ternary relationships, optional relationships, and the generalization abstraction. The extended entity-relationship model is then decomposed according to a set of basic entity-relationship constructs, and these are transformed into candidate relations. A set o ...

7 The entity-relationship model—toward a unified view of data

Peter Pin-Shan Chen

March 1976 **ACM Transactions on Database Systems (TODS)**, Volume 1 Issue 1

Full text available:  pdf(1.72 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A data model, called the entity-relationship model, is proposed. This model incorporates some of the important semantic information about the real world. A special diagrammatic technique is introduced as a tool for database design. An example of database design and description using the model and the diagrammatic technique is given. Some implications for data integrity, information retrieval, and data manipulation are discussed. The entity-relationship model can be used as a basi ...

**Keywords:** Data Base Task Group, data definition and manipulation, data integrity and consistency, data models, database design, entity set model, entity-relationship model,

logical view of data, network model, relational model, semantics of data

8 Representing extended entity-relationship structures in relational databases: a modular approach

Victor M. Markowitz, Arie Shoshani

September 1992 **ACM Transactions on Database Systems (TODS)**, Volume 17 Issue 3

Full text available:  pdf(3.18 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)


A common approach to database design is to describe the structures and constraints of the database application in terms of a semantic data model, and then represent the resulting schema using the data model of a commercial database management system. Often, in practice, Extended Entity-Relationship (EER) schemas are translated into equivalent relational schemas. This translation involves different aspects: representing the EER schema using relational constructs, assigning n ...

**Keywords:** database design, extended entity-relationship model, relational data model, schema translation, semantic data model

9 Towards a semantic view of an extended entity-relationship model

Martin Gogolla, Uwe Hohenstein

September 1991 **ACM Transactions on Database Systems (TODS)**, Volume 16 Issue 3

Full text available:  pdf(3.09 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Nearly all query languages discussed recently for the Entity-Relationship (ER) model do not possess a formal semantics. Languages are often defined by means of examples only. The reason for this phenomenon is the essential gap between features of query languages and theoretical foundations like algebras and calculi. Known languages offer arithmetic capabilities and allow for aggregates, but algebras and calculi defined for ER models do not. This paper introduces an extended ER m ...

**Keywords:** abstract data type, aggregate function, calculus, entity-relationship model, formal semantics, relational completeness, safeness, semantic data model

10 An entity-relationship approach to the implementation of frame-based systems

Sree R. K. Karakonda

September 1990 **Proceedings of the 1990 ACM SIGBDP conference on Trends and directions in expert systems**

Full text available:  pdf(660.12 KB)

Additional Information: [full citation](#), [references](#), [index terms](#)

11 Articles: Entity-Relationship modeling revisited

Antonio Badia

March 2004 **ACM SIGMOD Record**, Volume 33 Issue 1

Full text available:  pdf(95.13 KB)

Additional Information: [full citation](#), [abstract](#), [references](#)

In this position paper, we argue the modern applications require databases to capture and enforce more domain semantics than traditional applications. We also argue that the best way to incorporate additional semantics into database systems is by capturing the added information in conceptual models and then using it for database design. In this light, we revisit Entity-Relationship models and investigate ways in which such models could be

extended to play a role in the process. Inspired by a pap ...

**12 Teaching Database design through an Entity-Relationship approach**

C. Chrisman

February 1982 **ACM SIGCSE Bulletin , Proceedings of the thirteenth SIGCSE technical symposium on Computer science education**, Volume 14 Issue 1

Full text available: [pdf\(291.17 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This paper will describe how the Entity-Relationship approach is used in teaching an advanced Database course at Northern Illinois University. The Entity-Relationship approach provides a framework for the course to study basic issues in Database design and implementations in the major commercial Database Management Systems.

**13 Ternary relationship decomposition and higher normal form structures derived from entity relationship conceptual modeling**

Trevor H. Jones, Il-Yeol Song, E. K. Park

February 1996 **Proceedings of the 1996 ACM 24th annual conference on Computer science**

Full text available: [pdf\(986.80 KB\)](#) Additional Information: [full citation](#), [references](#), [index terms](#)

**Keywords:** conceptual modeling, entity relationship, higher normal forms, ternary relationship

**14 A virtual learning environment for entity relationship modelling**

Lynne Hall, Adrian Gordon

March 1998 **ACM SIGCSE Bulletin , Proceedings of the twenty-ninth SIGCSE technical symposium on Computer science education**, Volume 30 Issue 1

Full text available: [pdf\(740.86 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Entity Relationship Modelling (ERM) is a fundamental skill in database design. Though ERM concepts are simple, the modelling process itself is a complex activity. Novice ER modellers make systematic errors in their models. Current tool-based support for learning ER modelling is limited, since it concentrates on notation at the expense of methodology, and provides little or no feedback to the learner about the quality of her constructed models. A text-based virtual learning environment, based on ...

**15 An extended entity-relationship model for geographic applications**

Thanasis Hadzilacos, Nectaria Tryfona

September 1997 **ACM SIGMOD Record**, Volume 26 Issue 3

Full text available: [pdf\(562.18 KB\)](#) Additional Information: [full citation](#), [abstract](#), [citations](#), [index terms](#)

A special-purpose extension of the Entity-Relationship model for the needs of conceptual modeling of geographic applications, called the Geo-ER Model, is presented. Handling properties associated to objects not because of the objects' nature but because of the objects' position, calls for dealing -at the semantic modeling level-with space, location and dimensionality of objects, spatial relationships, space-depending attributes, and scale and generalization of representatio ...

**16 Event-entity-relationship modeling in data warehouse environments**

Lars Bækgaard

November 1999 **Proceedings of the 2nd ACM International workshop on Data warehousing and OLAP**

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index](#)

Full text available:  [pdf\(634.98 KB\)](#)[terms](#)

We use the event-entity-relationship model (EVER) to illustrate the use of entity-based modeling languages for conceptual schema design in data warehouse environments. EVER is a general-purpose information modeling language that supports the specification of both general schema structures and multi-dimensional schemes that are customized to serve specific information needs. EVER is based on an event concept that is very well suited for multi-dimensional modeling because measurement data oft ...

**Keywords:** data warehousing, event modeling, information modeling, multi-dimensional modeling, star schemes

**17 Automatic normalisation and entity: relationship generation through attributes and rôles**

Ken Meyer, John Doughty

November 1984 **ACM SIGMOD Record**, Volume 14 Issue 3

Full text available:  [pdf\(1.58 MB\)](#)Additional Information: [full citation](#), [references](#)

**18 Understanding relationships with attributes in entity-relationship diagrams**

Andrew Burton-Jones, Ron Weber

January 1999 **Proceeding of the 20th international conference on Information Systems**

Full text available:  [pdf\(215.85 KB\)](#)Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**19 Simulation languages and database theory: some considerations from the entity-relationship model**

Robert S. Roberts

December 1991 **Proceedings of the 23rd conference on Winter simulation**

Full text available:  [pdf\(682.89 KB\)](#)Additional Information: [full citation](#), [references](#), [index terms](#)

**20 Entity relationship models as a tool for data analysis and design**

Carol Chrisman, Barbara Beccue

February 1986 **ACM SIGCSE Bulletin**, **Proceedings of the seventeenth SIGCSE technical symposium on Computer science education**, Volume 18 Issue 1

Full text available:  [pdf\(665.87 KB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Many tools have been developed to aid in the systems analysis and design process. These same tools are used in teaching to help students better understand the process. This paper will discuss ways in which one tool, Entity Relationship (ER) models, can be used in teaching data analysis and design. The role of ER models in database design will be reviewed. ER models will be considered as a framework for also dealing with file design. An example of an ER model will be given with a description ...

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